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ABSTRACT

Evaluated with 22 educable mentally handicapped primary grade children were the cognitive and social dimensions of reflectivity-impulsivity (R-I) on match-to-sample tasks. Ss were individually administered the following tests; Matching Familiar Figures, Kansas Reflectivity-Impulsivity Scale for Preschoolers, and Test of Reflectivity-Impulsivity in Social Contexts. Results indicated that although EMR Ss demonstrated R-I distribution similar to that of non-EMR Ss, the first two moments of the distribution were different. Additionally, the Test of Reflectivity-Impulsivity in Social Contexts was shown to be a useful paper and pencil measure of social learning concepts, as well as a criterion measure of R-I in contexts other than perceptual tasks. (DB)

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ASSESSMENT of REFLECTIVITY-IMPULSIVITY in PRIMARY LEVEL EDUCABLE MENTALLY RETARDED CHILDREN

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in
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Research in the area of problem solving suggests that children often differ radically in the styles with which they approach and solve problems. Specifically, in problem situations having time constraints where valid inferences are critical to solution, Kagan (1965, 1966) has demonstrated differences in conceptual tempo. Studies have shown that about one-third of any sample of children are characteristically fast, but error-prone (impulsive), while another third are slower, but more accurate (reflective). Although these stylistic preferences, referred to as reflectivity-impulsivity (R-I), appear to be stable and generalizable to other tasks (e.g., persistence, distractibility, risk taking, play behavior, and so on) there does seem to be a developmental increase in the use of a reflective strategy.

A review of the current literature on the nature and development of conceptual tempo in problem solving indicates that a critical deficiency in our knowledge base exists with regard to educable mentally retarded youngsters. Although some researchers (c.f., Gozali, 1969; Wyne, Coop and Brookhouse, 1970; Berthelsen, 1972) have reported the R-I behaviors of EMRs on conventional measures of conceptual tempo, these studies do not explore possible differences between retarded and nonretarded children in R-I time and error scores,

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distribution and range of scores, or any other qualitative differences which might in fact exist.

On an *a priori* basis the Reflectivity-Impulsivity dimension is, by definition, related to the issue of "inhibition" and, hence, a relevant factor in assessing learning disabilities in the retardate. (Inhibition is here defined as an adaptive reduction in responding.) That is to say, impaired inhibition, as demonstrated by the tendency to offer the first answer without pondering various other possibilities, may account for the retardates ignoring relevant stimuli in a problem-solving situation. Indeed, early work by Razran (1933) and Mateer (1918) have shown that in learning paradigms, such as classical conditioning and discrimination learning, the retarded child,regardless of the grade of retardation, demonstrates "ubiquitous inhibition deficits." However, despite the apparent pertinence of conceptual tempo to the study of retarded children, theoretical conceptions and teaching methodologies for use with EMRs have given inadequate attention to this variable.

The research reported here focuses on supplementing present information regarding conceptual tempo in EMR children. In particular, the paper represents a departure from previous work in this area in that the notion of R-I is extended into social situations. Kagan's work and related research have primarily considered conceptual tempo in relation to perceptual tasks; *Ss* are typically required to match visual stimuli and visual standards. However, as a generic learner characteristic, R-I should be identifiable on tasks requiring not only perceptual abilities, but also a social knowledge base. That is, where the subject has to recognize a social situation, know what to do, and then identify a correct response. To this end, a socially based R-I measure, the Test of Reflectivity-Impulsivity in Social Contexts (TRISC) was constructed and piloted.

In addition to a further validation of conceptual tempo, it was felt that the development of a social context R-I measure was particularly suitable for use with EMR children. Considering that EMRs have been most often shown to fail in those social situations requiring the ability to think critically and act independently (Goldstein, 1969), the tendency to deal with social situations in an impulsive or reflective manner seemed to be a promising variable for study.

Thus, considering the ramifications of conceptual tempo, especially with regard to special education, the R-I dimension seems to be a pertinent learner characteristic with particular application to problem-solving deficits in the retarded. This study attempts to compare the performance of EMR children on two R-I tasks with available data on the performance of TMR and non-EMR children. In addition, the performance of a group of EMRs on a socially based R-I measure is analyzed and compared with their performance on conventional measures of R-I.

METHOD

Subjects

Twenty-two primary level children who had been classified as educationally mentally retarded and placed in special education classes in the West Essex Area School System of New Jersey were used as subjects.[3] These children were diagnosed as culturally and familially retarded. Thirteen of the subjects were male, nine were female. The chronological ages ranged from 6-6 to 12-4 years ($\bar{x}$ = 9.22); WISC I.Q. scores ranged from 63-88.

Measures

1. Matching Familiar Figures: The MFF (Kagan, et al., 1964) has not been published, but has been used extensively in its experimental form. In this task the subject was simultaneously shown a standard stimulus and six variants of the standard, one of which was identical to the standard. The stimuli were line drawings of familiar objects (e.g., bear, tree, boat, cowboy, and the like). The test consisted of two practice and twelve test items. The subject was instructed to choose from the six variants the one that was exactly like the standard. If the subject's initial solution was incorrect, he was instructed to try again. The variables scored were the response time to the first selection, the order in which errors were made in the trial, and the total number of errors made over the twelve trials.

2. Kansas Reflectivity-Impulsivity Scale for Pre-schoolers: The KRISP is a published experimental instrument (Wright, 1971). It differs from the MFF only in that simpler line drawings are used. There are five practice and ten test items, and the array of alternatives presented with each standard consisted of two to six variants. As in the MFF, response

time to first selection, order of errors, and total errors were scored.

3. Test of Reflectivity-Impulsivity in Social Contexts: The TRISC was constructed by the authors as a means of expanding the notion of R-I to social situations. Separate forms were constructed for female Ss (depicting female characters) and for male Ss (depicting male characters). The form of presentation was somewhat similar to the MFF and KRISP. The subject was presented with a stimulus referent (cf., standard) accompanied with a short description and a question read aloud by E. The subject was then shown an array of four alternative stimuli, one of which was the correct answer to the question. The following is an illustration of a TRISC item:

> -S is shown a line drawing of a paint-splattered table.
> -E says: "Here is a picture of a messy table. Point to the picture of the child who should clean up the messy table."
> -S is then shown pictures of a boy holding either a painting, a piece of sculpture, a camera, and hammer and chisel.
> -E says: "Point to the picture of the child who should clean up the messy table."

The TRISC consisted of three practice and ten test items. For the initial practice items S was shown the referent and alternatives simultaneously prior to the verbal message, while in subsequent practice items the alternatives were presented after the verbal message. As in the previous measures the position of the correct choice for each item was randomly rotated, and response time, order of errors, and total errors are recorded.[4]

The content of the TRISC items comes from some of the instructional materials in the Social Learning Curriculum (Lehrer, Mischio, and Heiss, 1971) encompassing such themes as responsibility, utilization of the environment, causality, and social interaction.[5] In this respect, there is an important

distinction between the TRISC and other measures of conceptual tempo. The content of the TRISC varies on two levels of complexity: cognitive and perceptual; in the MFF and KRISP only the perceptual complexity of the items are varied.

Procedure

For all three instruments, the standard/referent appeared on one page with the array of alternatives appearing on a separate page. All stimuli were encased in plastic and were secured in three ring binders in such a way that the standard for an item appeared on the sloping page above the rings (nearest to S). Every other page-turn produced a new item display.

After a warm-up period, the KRISP, the MFF (form 1-F), and the TRISC were individually administered to each subject, each of the three tests being given on a separate day. Subjects who demonstrated difficulty on the KRISP are not given the MFF. All testing was conducted by E and concluded within a three-week period.

The KRISP and MFF were administered by a procedure as close as possible to the standard one. The only modification were occasional repetition of both instructions and the five practice items. At the end of each session each S received a small toy. No guidance or prompting was given once the testing had begun. If a child did not finish in ten minutes, he was retested, beginning all over with the practice items a day or so later.

The total sample (N=22) were administered the TRISC. Thirteen children were administered the MFF, and nine children, the youngest in the sample, finding the MFF too difficult, were administered the KRISP.

The testing procedures of the KRISP and TRISC reflect the need to modify selectively existing testing procedures when working with a retardate population. As suggested by Denny (1964), retardated subjects only respond well to testing situations in a relaxed, face-to-face context. The initial warm-up period - which very often took more time than the actual testing - attempted to establish this E-S relationship. Similarly, these procedures attempted to assess the retarded child's conceptual tempo,while minimizing possible verbal deficits and motivational difficulties reported to adversely affect performance (House and Zeaman, 1963; Gerjuoy, et al., 1967; Zigler, 1967). Specifically assessing the MFF, Wyne, et al. (1970) found that measures of conceptual tempo requiring greater language competency than standard MFF instructions were not sensitive predictors of R-I. For this reason, the verbal messages accompanying the TRISC items were carefully constructed so as to diminish the role of S's verbal ability. It was also assumed that the presence of a tangible incentive served to raise the motivational level of S. Somewhat similar procedures have been employed by Wright (1972).

RESULTS

The mean time to first response and total errors on the KRISP, MFF, and TRISC were tabulated for each S. The data was analyzed separately in terms of younger children (mean age = 8-3) and older children (mean age = 9-3) and compared with samples of approximately equal chronological age reported by Kagan (1965) and Wright (1972). Table 1 shows the composition of these samples by age and I.Q. range.

Insert Table 1 about here

KRISP Measures

Table 2 shows the means and standard deviations of KRISP scores for the younger children, as well as the reported norms of retarded and nonretarded samples presented in Table 1.

Insert Table 2 about here

An analysis of variance of the mean scores for time, yielded an F - ratio of .04. Thus, although non-EMRs took more time before responding than EMRs and TMRs, and EMRs responded slightly slower than TMRs, this difference was not significant. However, the significant overall F - ratio for errors, F = 3.49, did indicate that there is a positive linear relationship between grade of retardation and errors (F linear, with 1 and 101 df = 6.92, P<.01).

MFF Measures

Table 3 shows the means and standard deviations of MFF scores for the older EMR children as compared to a non-EMR sample reported by Kagan (1965).

Insert Table 3 about here

As in the case of the KRISP time and error scores, the EMRs are taking less time and making more errors than the non-EMRs. Thus, as expected, the main effect of retardation per se is that retardates demonstrate less accuracy than nonretardates.

Relationship between time and error

The Pearson product moment correlations between KRISP/MFF and TRISC mean times and total error scores obtained in this study are reported in Table 4.

Insert Table 4 about here

Researchers (cf. Kagan, 1966; Wright, 1972) have generally found that time and errors are negatively correlated ranging between -.40 and -.60. As can be seen, the correlations between KRISP time and KRISP error and MFF time and MFF error ($r = -.51$ and $r = -.55$) are well within this range. Considering the correlations between TRISC time and error, there seems to be a clear cut difference between the younger and older children. For the younger sample the correlation is high and negative ($r= -.53$) and of the same magnitude as the correlation between KRISP time and errors, thus suggesting the appropriateness of the TRISC for this age group. However, the TRISC time and error correlation for the older children, although small ($r = .25$), is not in the predicted direction, perhaps indicating a ceiling effect as a function of age, whereby increased use of time does not necessarily yield fewer errors.

In addition, Table 4 shows intercorrelations of time and errors among the three measures of R-I employment in this study. As expected, the correlations between KRISP/MFF time and TRISC time, KRISP/MFF errors and TRISC errors are uniformly positive, while the correlations between KRISP/MFF errors and TRISC time, KRISP/MFF time and TRISC errors are uniformly negative though substantially smaller for the older children. Thus, the pattern of a generally negative relationship between time and errors and a positive relationship between time and time and error and error throughout all three measures of R-I appears to be established in Table 4.

The effect of age on conceptual tempo was analyzed and is reported in Table 5.

Insert Table 5 about here

Although the correlations are not significant, they do suggest a clear trend over all measures of R-I for decreasing errors and increasing response time with age.

Reflectivity-Impulsivity Continuum

Each child's position of the R-I continuum based on conventional measures of R-I, the KRISP/MFF, and social measure of R-I, the TRISC, was determined with reference to the median time and error scores of the children taking that test with him. The median scores for time on KRISP, MFF, and TRISC were 4.29, 7.46, and 4.85; the median scores for KRISP, MFF, and TRISC errors were 6.50, 14.00 and 5.27. Based on these medians Table 6 shows the percentage of children found in each of the four possible quadrants for both KRISP/MFF and TRISC scores.

Insert Table 6 about here

That is, combining the KRISP and MFF scores, 35 percent were above the median on error but below the median on time, 35 percent were below the median on error but above the median on time, 13 percent were above both median and 17 percent were below both medians. Similarly, considering the TRISC scores, 32 percent were above the median on error but below the median on time, 32 percent were below the median on error but above the median on time, 18 percent were above both medians. These quadrant distributions are consistent with those reported by other researchers using nonretardated samples.

In order to determine whether a child's performance on the KRISP/MFF and his performance of the TRISC would place him in identical quadrants, a within subject comparison of these scores was conducted. The analysis indicates that only for the younger children were the positions on the R-I continuum based on KRISP/MFF performance the same as their position based on TRISC

performance. These results, as well as the correlations reported in Table 4, argue for the significance of the TRISC as a measure of conceptual tempo in younger EMR children.

DISCUSSION

The overall findings with respect to R-I time and error suggest that the retarded children in these samples tend to respond faster and make more errors when compared with data from nonretarded samples. This finding supports various conceptualizations of problem-solving behavior in the retarded. For example, considering Benoit's theory (1957) stemming from a Hebbian analysis of information processing, the retardate is seen as a stimulus-bound organism - responding to the "stimuli of the moment," rather than internal maintaining stimuli or sets. The tendency to respond with the first inference that comes to mind may indeed reflect stimulus-boundness, as well as the general notion of inhibition deficits referred to earlier.

It should be noted, however, that this does not imply that retarded children tend to be impulsive. A child's position on the reflectivity-impulsivity continuum is a function of the median scores of the children who took the test with him. Thus, there are only relative, but not universal definitions of conceptual tempo; a reflective retarded child is not comparable to a reflective nonretarded child.

The finding that time increases and error decreases with age appears to stem from the more general developmental disposition to become increasingly concerned with avoiding mistakes (Kagan and Kogan, 1970). This disposition is also evidenced by substantial differences between various age groups with regard to risk-taking behavior (Cohen, 1960). Despite the fact that the older children have had more experience and sophistication in problem-solving techniques than the younger children, the former group had significantly longer response

latencies on the TRISC, indicating that the disposition to become more cautious with age is prevalent in retardates as well, although to a lesser degree. However, the gradient of increasing time is not commensurate with the gradient decreasing errors.

With regard to the validity fo the TRISC, the preliminary results seem to indicate that for primary level EMR children between ages 6-8 task performance may reflect skills and abilities which, although multidimensional in nature, are R-I measureable. In addition, Ss performance on the TRISC was related to performance on the KRISP/MFF; that is, impulsives were impulsives and reflectives were reflectives on both the social and conventional measures of R-I. The fact that this was not the case with the older children may be explained by considering that conceptual tempo refers only to problems with some degree of response uncertainty (i.e., several viable response alternatives are available simultaneously). For the older children, the task may have offered minimal uncertainty and was therefore not R-I measureable.

One of the shortcomings of the conventional R-I measure is that low levels of cognitive complexity appear to be required. For example, once the child understands the concept of "sameness," the processes of labeling and identifying the parts of the problem are sufficient for a solution; higher order processes, such as inferring, predicting, and generalizing, are superfluous and may lead to unnecessary reflection on the part of the problem solver. If, as postulated by Kagan, conceptual tempo influences problem-solving strategies, an R-I measure should tap the conceptual tempo involved at all levels of problem solving. To this end, the TRISC is being expanded, so as to contain items depicting varied and more complex social situations, requiring higher order cognitive processes for solution. Moreover, the long-range orientation is aimed at revising the

TRISC format so as to put Ss in an operant rather than a respondent condition, perhaps using behavioral indices of reflectivity and impulsivity. Thus, the TRISC will serve both as an extension of conceptual tempo into social contexts, as well as a better index of conceptual tempo in higher order levels of problem solving.

There are several basic pedagogical implications of this study. The first implication argues for an appreciation of R-I as a salient learner characteristic. Clearly, children have different conceptual tempos, which influence their approach to learning tasks and which should be considered when evaluating the child. As Kagan (1965) has pointed out, even when teachers are cognizant of the R-I dimension, there is a tendency to distort the concepts of reflectivity and impulsivity; often putting a premium on reflectivity. However, neither reflectivity nor impulsivity alone is always helpful or harmful to the child. While it is true that the reflective in general appears more intellectually mature and resembles the older child, there are important areas in early education where the impulsive may enjoy a compensating advantage. Some of the academic contents children must master require reflection and analysis - for instance, mathematics and the physical sciences. But maximal productiveness and mastery of principles in aspects of the arts, social studies, and humanities may be hampered by an excessively reflective orientation. Thus, the "ideal child" is not necessarily the reflective problem solver or the impulsive problem solver; he is, perhaps, the "efficient" problem solver.

The need to reevaluate the notion of R-I in terms of an "efficient" conceptual tempo, and consequently the expression of this tempo in terms of an "efficiency score," stems from the belief that reflectivity and impulsivity are not merely styles distinguishing "slow" children from "fast" children.

Rather, the inefficient use of time, owing primarily to a lack of an appropriate problem-solving strategy, is an underlying factor in both reflectivity and impulsivity. As suggested by Goldstein (1972), both reflective and impulsive EMR children demonstrate diverse reactions to problem solving. Reflectives don't know what to do and therefore take an inordinate amount of time. Impulsives dont' know what to do, perceive the task as an unpleasant situation, and consequently respond quickly with the first answer to come to mind. In this respect, efficient conceptual tempo could perhaps be depicted best as a continuum of numerical scores with inefficient problem solvers (high time, high error) on one extreme, reflectives and impulsives in the center, and efficient problem solvers (low time, low errors) on the opposite extreme. Thus, while in typical R-I research subjects who are low on time and low on errors and subjects who are high on time and high on errors are eliminated, the notion of conceptual tempo efficiency would permit the full use of the sample. In addition, contrary to placing reflective Ss in a positive standing, this continuum will represent both reflectives and impulsives in a more accurate perspective - i.e., moderately inefficient problem solvers. Research currently underway is attempting to formulate this continuum.

Footnotes

1. The preparation of this paper was supported by a grant from the U.S. Office of Education, Bureau for the Education of the Handicapped, Project #6-1368.

2. Portions of this paper were presented at the Third International Symposium on Learning Disabilities, Miami Beach, Florida, October, 1973.

3. The authors wish to thank Mr. Boris Schwartz, Director of Special Education Services, and Mr. Mahler, Mrs. Freeman, and Mrs. Skinner for their cooperation and assistance.

4. According to House and Zeaman (1957), position responses are typically the easiest for the mentally retarded to learn. Randomization of the correct alternative is, therefore, an essential precaution when presenting retarded subjects with an array of stimuli.

5. See Goldstein (1969) and Heiss and Mischio (1971) for an extended discussion of the rationale underlying the construction of the SLC.

Table 1

Characteristics of Samples

Type of Child		N	R-I Measures	C.A. Range (Approx.)	I.Q. Range (Approx.)
(I)	EMR	9	KRISP-TRISC	6 to 11 years	60-70
(II)	EMR	13	MFF-TRISC	8 to 12 years	60-80
(III)	TMR[a]	70	KRISP	8 to 14 years	30-50
(IV)	Non-EMR[a]	25	KRISP	5 to 6 years	100-120
(V)	Non-EMR[b]	65	MFF	First Grade	Unspecified

[a]Wright (1972)

[b]Kagan (1965)

Table 2

Norms for KRISP Time and Errors
for Retarded and Nonretarded Samples

Sample Source		Time to first response (sec) $\bar{X}$	S.D.	Total Errors/10 items $\bar{X}$	S.D.
(IV)	Non-EMR	4.83	2.01	2.12	2.35
(I)	EMR	4.58	1.21	5.78	2.95
(III)	TMR	4.46	2.45	8.31	4.83

$F = .04$ with 2 & 101 df

$F = 3.49$ with 2 & 101 df ($P<.01$)

Table 3

Norms for MFF Time and Errors
for Retarded and Nonretarded Samples

Sample Source	Time to first response (Sec.) $\bar{x}$	S.D.	Total Errors/12 items $\bar{x}$	S.D.
(II) EMR	9.93	5.19	17.92	6.23
(V) Non-EMR	11.70	Not Reported	15.10	Not Reported

Table 4

Correlations Between Mean Time to First Response and Total Errors on KRISP/MFF and TRISC[a]

	1	2	3	4
1. KRISP/MFF response time	-	-.51	.68	-.04
2. KRISP/MFF error	-.55	-	-.70	.69
3. TRISC response time	.55	-.30	-	-.53
4. TRISC error	-.24	.35	.25	-

[a] Correlations for the younger children are above the diagonal; correlations for the older children are below the diagonal.

Table 5

Correlations Between Time and Errors on the KRISP, MFF and TRISC and Chronological Age

	C.A.
KRISP time	.41
KRISP errors	-.04
MFF time	.16
MFF errors	-.27
TRISC time (younger sample)	.16
TRISC errors (younger sample)	.04
TRISC time (older sample)	.02
TRISC errors (older sample)	-.20

Table 6

Percentages of EMR Children in Each Quadrant of KRISP/MFF and TRISC Score Distributions[a]

Time	Above Median	Below Median
Above Median	13% / 18%	35% / 32%
Below Median	35% / 32%	17% / 18%

[a] Percentages based on the KRISP/MFF are above the diagonals; percentages based on the TRISC are below the diagonals.

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